REMARKS

Responsive to the Office Action dated March 4, 2002, claims 1-5 have been amended, claims 6 and 7 have been canceled and new claims 8-10 have been added. Claims 1-5 and 8-10 are currently pending in the application. No new matter has been added. Reconsideration of the claims is respectfully requested.

In paragraph 3 on page 2 of the Office Action, the drawings were objected to because the titles of the figures were placed on the body of the figures.

The Applicant respectfully traverses the objection to the drawings, but in order to advance prosecution of the application has canceled Figs. 1 and 2 and submits under separate cover a PROPOSED DRAWING CHANGE to replace original Figs. 1 and 2. The PROPOSED DRAWING CHANGE, submitted herewith, includes a new substitute Figure 1 which is original Figs. 1 and 2 combined into a single figure. Substitute Figure 1 clarifies the specification and the claims without adding new matter. The Applicant respectfully asserts that the objections to the drawings are now moot in view of substitute Figure 1. Formal drawings will be submitted upon approval of the substitute figure and allowance of the application.

In paragraphs 4-6 on pages 2-6 of the Office Action, the specification was objected to for numerous cumulative minor informalities.

The Applicant respectfully traverses the objections to the specification, but in order to advance prosecution has submitted a substitute specification to overcome the objections. A clean and a marked up copy of the substitute specification is included herewith and no new matter has been added. The clean copy has been annotated as "Clean Sub Spec" and the marked up version has been annotated as "Marked up Sub

Spec" in the footer areas, respectively thereof. Applicant respectfully requests entry of the substitute specification because all requirements of C.F.R. §1.125 have been fulfilled. In view of the amendments set forth in the substitute specification, the Applicant respectfully asserts that the objections to the specification are now moot.

In paragraph 8 on page 6 of the Office Action, claims 1-7 were rejected under 35 U.S.C. §112 second paragraph for being indefinite.

The Applicant respectfully traverses the rejections, but has amended the application to overcome the rejections. Claims 1-5 have been amended and claims 6 and 7 have been canceled. It is believed that all claims comply with 35 U.S.C. §112.

In paragraph 10 on page 7 of the Office Action, claims 1-7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Applicant's admitted prior art in view of Ho. According to the Office Action, the Applicant's alleged admitted prior art discloses all the limitations set forth in Applicant's claimed invention except to accelerate call setup, checking functions are carried out during voice mode connection of the call. However, according to Office Action, Ho teaches the limitation and that it would have been obvious to have combined the teachings of Applicant's alleged admitted prior art and Ho to arrive at the Applicant's claimed invention.

The Applicant respectfully traverses the rejections. The Applicant respectfully submits that the cited references do not disclose, teach or suggest the Applicant's invention, as set forth in independent claim 1. The Applicant respectfully submits that there are patentable differences between the cited references and the Applicant's claimed invention. The Applicant's invention differs from the cited references for at least the following reasons.

The Applicant sets forth, in independent claim 1, a procedure for setting up a call in a wireless local loop. The wireless local loop is based on mobile communication technology in which terminal units are connected via a radio link to an access node. The terminal units are connected from the access node to a wired network local exchange. Checking functions are performed in order to accelerate call setup. The checking functions are carried out after voice mode has been set.

The Applicant's claimed invention performs checking functions after voice mode has been set. Checking functions are set forth in the specification as identification and authentication functions (page 4, lines 13-18, clean substitute specification). The Applicant's Figure 1 sets forth initial call setup procedures to include voice mode setup in elements 1-24, for example, channel request (e.g., 1), channel activation (e.g., 3), allocation (e.g., 13), setup (e.g., 17) and connect (e.g., 23). Elements 25-28 in Figure 1 set forth the checking functions that occur after voice mode has been established. For example, the checking functions, i.e., identification request and identification response (e.g., 25 and 26) and authentication request and authentication response (e.g., 27 and 28), as illustrated in substitute Figure 1, are carried out after voice mode has been set in elements 1-24.

The Applicant respectfully traverses the Office Action's characterization that the Applicant's specification is admitted prior art. The Applicant submits, rather, that the specification adequately teaches one of ordinary skill in the art to make and use the present invention, as set forth in the claims, without undue experimentation, as discussed above.

Ho merely discloses using different channels for completing call setup depending on the determined call type. Ho merely performs security functions during initial call setup in the same manner as the alleged Applicant's admitted prior art. Ho is different than the Applicant's claimed invention because Ho merely discloses a procedure for carrying out security checking functions during initial call setup, which is in contrast to Applicant's claimed invention of the checking function performed after call setup, and using different channels to complete a call based upon the type of call being made whereas the Applicant's claimed invention sets forth performing checking functions after voice mode has been set.

A significant advantage is obtained by the Applicant's claimed invention. By avoiding timing out the public switched telephone network, a greater number of calls are completed and the reliability of the system is enhanced.

For at least the reasons set forth above, the Applicant respectfully asserts that claim 1 is allowable over the cited references.

Because claims 2-5 and 8-10 depend, directly or indirectly, from independent claim 1 and include the features set forth in the independent claims, as well as additional features, the Applicant respectfully submits that claims 2-5 and 8-10 are also patentably distinct over the cited references. Nevertheless, the Applicant is not conceding the correctness of the Office Action's position with respect to such dependent claims and reserves the right to make additional arguments, if necessary.

On the basis of the above amendments and remarks, it is respectfully submitted that the claims are in immediate condition for allowance. Accordingly, reconsideration of this application and its allowance is earnestly solicited.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Agent for the Applicant, Michael T. Wallace, at 952.253-4127.

Respectfully submitted,

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APPENDIX A
MARKED UP AMENDMENTS TO THE CLAIMS

IN THE CLAIMS

Please amend claims 1-5 as follows.

1. (Amended Once) [Procedure] A procedure for setting up a call in a wireless local loop [, which is] based on mobile communication technology and in which subscriber terminal units [(TU)] are connected via a radio link to an access node [(AN)] and from the access node to a wired network local exchange [(LE) via a standard V5 interface] and in which checking functions [consistent with a mobile communication specification] are carried out, [characterised in that,] to accelerate call setup, wherein the procedure comprises checking functions that are carried out after [during] voice mode has been set [connection of the call] .

2. (Amended Once) [Procedure] The procedure as defined in claim 1, wherein [characterised in that subscriber terminal units (TU) are connected to the access node via a radio link consistent with the GSM specification ; and that checking functions are carried out,] said checking functions [comprising change of the] comprise: changing a subscriber identity code; [(TMSI reallocation),] verification of [the] authenticity of [the] a subscriber; [(authentication) and/or] and verification of a [the] subscriber's equipment identity code [(IMEI check)].

3. (Amended Once) [Procedure] The procedure as defined in claim 2, wherein [characterised in that the change of] changing the subscriber identity code is via an [a TMSI reallocation] allocation of a temporary subscriber identity code [consistent with the GSM 04.08 4.3.1. standard].

4. (Amended Twice) [Procedure] The procedure as defined in claim 2, wherein [characterised in that the] verification of subscriber authenticity is via an authentication request [consistent with the GSM 04.08. 4.3.2 standard].

5. (Amended Twice) [Procedure] The procedure as defined in claim 2, [characterised in that the] wherein verification of the subscriber's equipment identity code is via a [an IMEI] check of a subscriber's international mobile station equipment identity code [consistent with the GSM 04.08. 4.3.3 standard].

6. (Amended Once) Procedure as defined in claim 1, c h a r a c t e r i s e d in that the V5 interface is a V5.2 interface consistent with the ETS 300 347-1 standard.

7. (Amended Once) Procedure as defined in claim 1, c h a r a c t e r i s e d in that the V5 interface is a V5.1 interface consistent with the ETS 300 324-1 standard.

[PROCEDURE FOR SETTING UP A CALL IN A WIRELESS LOCAL LOOP]

PROCEDURE FOR SETTING UP A CALL IN A WIRELESS LOCAL LOOP

BACKGROUND OF THE INVENTION

The present invention relates to a procedure [as defined in the pre-amble of claim 1] for accelerating call setup in a wireless local loop.

In a wireless local loop (WLL, Wireless Local Loop or RLL, Radio in Local Loop), a terminal unit is connected via a wireless link to an access node (AN). The access node may consist of multiplexers, crossbar switches and various transmitting systems. The WLL system may be based, e.g., on technology used in mobile telephone systems, such as the GSM/DCS1800 technology (GSM, Global System for Mobile Communications; DCS, Digital Cellular System). GSM is a European digital mobile communication system standardised by ETSI. DCS-1800 is a mobile communication system standardised by ETSI, which is based on the GSM specification and aims at a more effective use of microcells and which works in the frequency range of 1800 MHz. Between the terminal unit and the access node there is a base transceiver station, through which call signals received from the terminal unit over a radio channel are transmitted via the access node to a public telephone network and vice versa. The access node can be connected to the telephone exchange using, e.g., a V5.2 protocol consistent with the ETS 300 347-1 standard or a V5.1 protocol consistent with the ETS 300 324-1 standard. The access node functions as a converter between GSM signalling and V5 signalling.

During call setup in a local loop, various checking functions related to network security management are carried out. The checking functions are designed to prevent illicit access to the network for users who have no right to use it, and to prevent the use of e.g. a mobile station reported stolen. The checking operations defined by the GSM specifications, carried out during call setup, retard the call setup process so that the V5 signalling time-outs are tripped and the call must be disconnected even though it is most likely to be successful. In a wireless local loop, fast setup of an outgoing call is particularly important.

An operation retarding call setup is, e.g., change of the subscriber identity code (TMSI reallocation), which means changing the temporary subscriber identity code assigned for the subscriber by the visitor location register and allowing confidential subscriber identification, e.g., during the call. Another check retarding call setup is the verification of the subscriber's access right, i.e., subscriber authentication, which means checking the subscriber data of a mobile station and preventing illicit access to the network. A third check retarding call setup is the verification of the subscriber's equipment identity code (IMEI check). To check the equipment identity code, it is compared with a register of equipment identity codes of mobile stations reported stolen and/or defective. IMEI is an international mobile station equipment identity code, by means of which a mobile station can be unambiguously identified.

Especially the time-outs in the PSTN protocol in the V5 interface (standard ETS 300 324-1 1 13) cause problems in call setup in a wireless local loop system. For instance, in the case of a terminating call, the time-out according to the V5 PSTN protocol between the start message and the acknowledgement

message (the telephone rings) is max. 4 seconds (standard ETS 300 324-1 13.6).

SUMMARY OF THE INVENTION

The object of the present invention is to eliminate the drawbacks described above.

A specific object of the invention is to present a procedure that can be used to accelerate call setup so that unnecessary tripping of time-outs and needless disconnection of calls are avoided and the time available for the signalling needed for the call setup itself is increased.

[The procedure of the invention is characterised by what is presented in claim 1.]

According to the invention, to accelerate call setup, checking functions are performed during voice mode connection of the call instead of being performed during call setup. The invention provides the advantage that more time is made available for the signalling needed for call setup while possible tripping of time-outs and unnecessary disconnection of the call are avoided.

In an embodiment of the procedure, subscriber's terminal units are connected to an access node via a radio link consistent with the GSM specification and checking functions are carried out, said functions comprising change of the subscriber identity code (TMSI reallocation), verification of subscriber authenticity (authentication) and/or verification of the subscriber's equipment identity code (IMEI check).

In an embodiment of the procedure, the change of the subscriber identity code is TMSI reallocation consistent with the GSM 04.08 4.3.1. standard.

In an embodiment of the procedure, the verification of subscriber authenticity is an authentication consistent with the GSM 04.08. 4.3.2 standard.

In an embodiment of the procedure, the verification of the subscriber's equipment identity code is an IMEI check consistent with the GSM 04.08. 4.3.3 standard.

In an embodiment of the procedure, the V5 interface is a V5.2 interface consistent with the ETS 300 347-1 standard.

In an embodiment of the procedure, the V5 interface is a V5.1 interface consistent with the ETS 300 324-1 standard.

BRIEF DESCRIPTION OF THE DRAWING

Referring now to the drawing:

Figure 1 is a signalling diagram for call setup and voice mode connection according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[The figure] Figure 1 presents a signalling diagram representing a call originated by a terminal unit TU in a wireless local loop and substantially corresponding to a mobile-originated call MOC consistent with the GSM specifications. The system components in the diagram are a base transceiver station BTS, an access node AN, i.e., a node of an access network, and a local exchange LE.

The access node AN has three program segments called registers. These are an equipment identity register, an authentication register and, hierarchically above these, a visitor location register. The equipment identity register contains the international mobile station equipment identity numbers (IMEI). An equipment identity number may be placed on a white, grey or black list, and in response to an IMEI check the equipment identity register returns the list colour of the IMEI concerned. The authentication register produces the triplets needed in authentication and contains the data required for authentication. The functions of the visitor location register include making the decision about carrying out the checks.

In the GSM/DCS world, the following register terms are used: authentication centre AUC [;] or AC, equipment identity register EIR and visitor location register VLR. In conjunction with a wireless local loop, the visitor location register is designated WFR (wireless fixed register).

Call setup in a wireless local loop in the so-called non-transparent mode as presented in the figure is substantially identical with call setup in a conventional GSM system. In a wireless local loop system, the access node AN

also comprises functions that are included in the mobile switching centre/visitor location register MSC/VLR and home location register/authentication centre/equipment identity register (HLR/AC/EIR) of an ordinary GSM system. In a wireless local loop, the subscriber terminal units communicate with the access node AN by radio. The signalling between the terminal unit and the access node AN is message based signalling consistent with the GSM specifications (GSM/DCS). The access node AN is connected to a wired network local exchange LE via a V5.2 interface consistent with the ETS 300 347-1 standard.

When the subscriber picks up the receiver, the terminal unit generates a local dial tone. The subscriber has a predetermined period of time to dial the first digit. The dial tone goes out as soon as the first digit has been dialled. The item numbers below correspond to the numbering in the figure.

1. Call setup is started upon the lapse of a predetermined period of time after the last digit has been dialled. The terminal unit TU requests a call by sending a CHANNEL_REQUEST message to the base transceiver station BTS.

2. The base transceiver station BTS transmits a CHANNEL_REQUIRED message to the access node AN, which starts a search to find a communication channel.

3. After a communication channel has been successfully allocated, the access node AN activates the channel by sending a CHANNEL_ACTIVATION message to the base transceiver station BTS.

4. The base transceiver station acknowledges activation by returning a CHANNEL_ACTIVATION_ACK message. The base transceiver station BTS

starts transmission and reception on this channel using the power and timing data received in this message.

5. After the communication channel has been successfully activated, the access node AN sends an IMMEDIATE_ASSIGNMENT_COMMAND message to the base transceiver station BTS.

6. This message contains an IMMEDIATE_ASSIGNMENT message, which the base transceiver station BTS sends to the terminal unit TU.

7. Having received the IMMEDIATE_ASSIGNMENT message, the terminal unit TU is tuned to the specified communication channel and starts setting up a signalling link over the network. The terminal unit TU sends a layer-2 SABM (CM_SERV_REC) message to the base transceiver station BTS via the communication channel. The SABM contains a layer-3 service request message.

8. The base transceiver station sends the service request of the terminal unit further to the access node AN in an ESTABLISH_INDICATION message, which includes the subscriber's temporary mobile subscriber identity (TMSI) code.

9. The base transceiver station BTS acknowledges the SABM message by sending a UA frame to the terminal unit TU.

10. The access node finds the subscriber's L3 address (using the TMSI and IMSI) and checks the state of the corresponding V5 interface. If call setup is allowed, the access node AN sends an [establish] ESTABLISH (SS=OFFHOOK) message to the local exchange LE.

11. At the same time, the access node AN starts encryption by sending an ENCRYPTION_COMMAND message to the base transceiver station BTS. The

base transceiver station BTS analyses the command. If encryption is needed, the base transceiver station BTS activates a demodulator for the deciphering of the encryption.

12. If encryption is used, the base transceiver station BTS sends a CIPHERING_MODE_COMMAND message to the terminal unit TU.

13.-14. The local exchange LE sends to the access node AN an ALLOCATION message, which contains the time slot used in the V5.2 interface. The access node AN acknowledges this by sending an [ALLOCATION COPMLETE] ALLOCATION_COMPLETE message to the local exchange LE.

15. After receiving the CIPHERING_MODE_COMMAND message, the terminal unit TU starts encryption deciphering and ciphering using an available ciphering key and returns to the base transceiver station BTS, in ciphered form, a CIPHERING_MODE_COMPLETE message or the next message it is to send. Upon receiving the [CIPHERING MODE MOMPLETE] CIPHERING_MODE_COMPLETE message (or any layer-2 frame correctly ciphered), the base transceiver station BTS starts encryption and transfers the message transparently to the access node AN.

16. When the local exchange LE is ready to receive a dialled number, it sends an ESTABLISH_ACK message to the access node AN. A connection between the access node AN and the local exchange LE is set up and the speech path is connected through.

17. The terminal unit TU starts call setup by a SETUP message, which contains e.g. the number of the called subscriber and the call type (voice/data). The access node AN checks in the VLR/HLR database whether call setup is

allowed for the subscriber. If the right conditions are fulfilled, then the access node AN sends the [DTMF] DTMFS (dual tone multi-frequency signal) numbers (together with the V5 messages) to the local exchange LE.

18. Having sent the numbers, the access node sends a CALL_PROCEEDING message to the terminal unit TU, indicating that the call is under processing.

19.-22. The channel mode is changed from signalling to voice via a "mode modify" procedure. First, the access node AN sends a MODE_MODIFY message to the base transceiver station BTS to change the channel mode. Synchronisation by a transcoder begins. After receiving a MODE_MODIFY_ACK message, the access node starts the channel mode change process and sends a CHANNEL_MODE_MODIFY message to the terminal unit TU. This command is transparent to the base transceiver station BTS. Having received the CHANNEL_MODE_MODIFY message, the terminal unit TU changes the channel mode from signalling to voice and sends an acknowledgement to the access node AN with a CHANNEL_MODE_MODIFY_ACK message. This message, too, is transparent to the base transceiver station BTS.

23.-24. The terminal unit TU is set to voice mode by sending a CONNECT message to it. The terminal unit TU acknowledges this by sending a CONNECT_ACK message. The subscriber now hears the ring-back tone from the local exchange LE.

25.-26. If the visitor location register VLR of the access node does not recognise the temporary TMSI code, then the international mobile subscriber identity IMSI is requested by an IDENTIFICATION_REQUEST message. In

response, [and] an IDENTIFICATION_RESPONSE message is sent to the terminal unit TU.

27. The access node AN starts authentication by sending an AUTHENTICATION_REQUEST message to the terminal unit TU.

28. The terminal unit TU sends a calculated response in an AUTHENTICATION_RESPONSE message to the access node AN.

The invention is not restricted to the examples of its embodiments described above, but many variations are possible within the scope of the inventive idea defined by the claims.

ABSTRACT

[Procedure] A procedure for setting up a call in a wireless local loop [, which is] based on mobile communication technology [and] in which terminal units [(TU)] are connected via a radio link to an access node [(AN)] and from the access node to a wired network local exchange [(LE)] via a standard V5 interface [and] in which checking functions consistent with a mobile communication specification are carried out is disclosed herein. To accelerate call setup, checking functions are carried out during voice mode connection of the call.